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5 **TRAFFIC MEASUREMENT COLLECTION IN A
TELECOMMUNICATION NETWORK**

BACKGROUND OF THE INVENTION

10 Technical Field of the Invention

The present invention relates to telecommunications and, more particularly, to an apparatus, system and method for traffic measurements in a telecommunication network.

Description of Related Art

15 Within the telecommunication industry, an ever present need exists to accurately manage traffic flow. A knowledge of accurate traffic flow allows a network operator to balance loads among different nodes within a network so that network overloading and other problems may be reduced. Reduced network overloading in turn improves overall network performance.

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5 The network operator can use traffic flow information to prevent further
traffic congestion on a network node, for example, which may overload and/or
degrade performance. The network operator can eliminate the overload by rerouting
the traffic sources which are causing the congestion event. Traffic information may
also be used for other network management functions such as decisions regarding
10 traffic source database sharing, for example.

With ever increasing development and subsequent deployment, new network
services can be introduced by local exchange carriers, for example, more rapidly and
with fewer associated development costs than earlier in networks. Not surprisingly,
operators have successfully introduced a myriad of new network services to network
15 subscribers in the past few years, and many more can be expected in the future.

As a result of the introduction of this myriad of new network services, the
flow of network traffic at various levels of the network will increase substantially,
and the need to effectively monitor and control network traffic will become an even
more important necessity to prevent network overload related problems.

20 Traffic measurements can be performed at several locations within a
telecommunication network and several techniques may be employed. For example,
traffic metering can be performed continuously on each traffic linkset. However,

- 5 continuously metering communication linksets requires extensive time and usage of
network assets.

Another method for traffic metering is to sample only a small percentage of
network traffic on each linkset or to only sample a small percentage of linksets. By
sampling infrequently, data gathering (collection) and/or storage searches required
10 during traffic rate estimation is reduced. Infrequent sampling, however, also reduces
estimation accuracy unless a large number of samples are taken (which further
consumes time and processing power). Accuracy must therefore be balanced with
cost in these type of sampling configurations.

5 **SUMMARY OF THE INVENTION**

10 The present invention achieves technical advantages as an apparatus, system
and method of traffic measurement for a node in a telecommunication network. A
communication linkset is monitored and a traffic measurement collection is triggered
when the linkset is determined to be overdriven or overloaded. For an overloaded
linkset, outbound messages are examined to determine the associated communication
linksets providing traffic to the overloaded linkset and a count is initiated for
messages received on those inbound linksets. A separate threshold value can be
selected for each communication linkset in the node and a set of communication
linksets can be selected for continuous measurement collection. The traffic
15 measurement collection is terminated after a predetermined period or following a
determination that the rate of outgoing messages has reached a predetermined
underload threshold. Measurements can be collected in a type of array for each
communication linkset and stored for future use.

5 **BRIEF DESCRIPTION OF THE DRAWINGS**

For a more complete understanding of the present invention, reference is made to the following detailed description taken in conjunction with the accompanying drawings wherein:

Figure 1 illustrates a system diagram of a telecommunication network for
10 traffic measurement collection in accordance with an exemplary embodiment of the present invention;

Figure 2 illustrates a block diagram of an signal transfer point which includes a traffic measurement device in accordance with an exemplary embodiment of the present invention;

15 Figure 3 illustrates a block diagram of a traffic measurement device in accordance with an exemplary embodiment of the present invention;

Figure 4 illustrates a tabulation or array of traffic measurement results for a traffic measurement device in accordance with an exemplary embodiment of the present invention; and

- 5 Figure 5 illustrates a simplified method diagram for traffic measurement collection in a telecommunication network in accordance with an exemplary embodiment of the present invention.

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5 **DETAILED DESCRIPTION OF THE INVENTION**

The numerous innovative teachings of the present application will be described with particular reference to the presently preferred exemplary embodiments. However, it should be understood that this class of embodiments provides only a few examples of the many advantageous uses and innovative
10 teachings herein. In general, statements made in the specification of the present application do not necessarily delimit any of the various claimed inventions. Moreover, some statements may apply to some inventive features, but not to others.

Referring now to Figure 1 there is illustrated a system diagram of a telecommunication network 10 for traffic measurement collection in accordance with
15 an exemplary embodiment of the present invention. The network 10 can include a plurality of network nodes or signaling points coupled by communication linksets. The communication linksets may, for example, comprise coaxial cables, optical fiber bundles, or microwave links, and the network nodes may comprise a trunk exchange switch node, a local exchange switch node, a special service switch node, some form
20 of mobile telecommunications network, or the like.

A signaling point has the ability to perform message discrimination (read the address and determine if the message is for that node), as well as to route or transfer messages to another signaling point. There are three different types of signaling

5 points illustrated in Figure 1, although other types of signaling points and associated
databases and registers are contemplated. The signaling points include: 1) Service
Switching Point (SSP) 16, Signal Transfer Point (STP) 14, and Service Control Point
(SCP) 12. The traffic measurement device (TMD) is shown to be associated with the
STP 14, however, it can also be associated with the other signaling points. It should
10 be understood that this example is only illustrative, and that many other system
configurations are possible.

The signaling points provide access to the network 10, provide access to
databases used by switches inside and outside of the network, and transfer messages
to other signaling points within the network 10. The signaling points are generally
15 deployed in pairs for redundancy and diversity. The network is interconnected to
ensure the network can provide alternate paths in the event of failures. These
alternate paths provide the reliability needed in a network of this nature to provide
insurance that messages can always reach their destinations. To assist in this type
of route management, message traffic is monitored for analysis so that network
20 routing efficiency can be improved.

Referring now to Figure 2 there is illustrated a block diagram of an STP 14
which includes a traffic measurement device (TMD) 22 in accordance with an

5 exemplary embodiment of the present invention. The STP 14 also includes an
operatively coupled plurality of communication linksets 28.

The TMD 22 triggers the collection of traffic measurements when the rate of
outgoing message signaling units (MSUs per second) on a particular communication
linkset exceeds a user provisioned or predetermined value. Note that a separate user
10 provisioned value can be assigned to each outbound communication linkset to be
monitored. A communication linkset can be considered overdriven, for example,
when the rate of outgoing messages, (e.g., MSUs per second) has exceeded the
engineered capacity of the linkset. When this happens, the TMD equipped STP 14
is triggered to start collecting measurements for the linkset on which the messages
15 came into the STP 14.

Note that the traffic measurement device 22 is illustrated coupled directly to
the STP 14, however, the traffic measurement device 22 can be coupled within or
remotely from the STP 14 or any other network node as previously mentioned. It
should also be noted that the traffic measurement device 22 can be implemented in
20 hardware, software or a combination thereof.

Referring now to Figure 3 there is illustrated a block diagram of a traffic
measurement device (TMD) 22 in accordance with an exemplary embodiment of the

5 present invention. The TMD 22 includes a monitor/detector 32, an examining unit
34, and a counter 36. The monitor/detector 32 has an input for receiving the
messages (i.e., message signaling units) to be transmitted on one or more
communication linksets. The monitor/detector 32 is further operably configured to
determine the outgoing message rate on each of the communication linksets to be
10 monitored and to compare this message rate to a respective overload threshold for
detection of an overload threshold transition. The monitor/detector 32 is also
configured to send a signal, on an output 33, indicating the detection of the overload
threshold transition with respect to a particular outbound linkset. It should be noted
that one or more linksets can be monitored simultaneously.

15 The examining unit 34 includes a first input for receiving an indication of a
detection of the overload threshold transition for a particular outbound linkset and,
upon receiving such an indication, commences measurement collection. The
examining unit 34 includes a second input for receiving the messages to be
transmitted on a communication linkset determined to be overloaded, and is
20 configured to examine those messages to determine the communication linksets on
which they were received. This identifies the communication linksets which are
contributing to the overload communication linkset condition.

5 The counter 36 is coupled to the examining unit 34 to receive therefrom at
37 information indicative of the communication linksets that have been identified by
the examining unit 34. In response to this information, the counter 36 begins
counting the number of incoming messages received on each of the identified
communication linksets. The counter 36 also has an input 39 for receiving
10 information indicative of the message unit traffic on the identified communication
linksets, for example, the inbound messages themselves. The counter 36 is
configured to increment a count element for each message received, and tabulate
and/or store the incremental count for each respective identified communication
linksets that the examining unit 34 has associated with the overloaded
15 communication linkset. In other words, the TMD 22 builds a one dimensional array
that contains the counts of MSUs received from each possible linksets.

For example, if communication linkset number 25 is detected as being in the
traffic overload state, the TMD 22 begins collection measurements on each of the
linksets that can contribute traffic to the linkset number 25. The message distribution
20 for linkset number 25 can be arranged in tabulation or array form. Figure 4
illustrates an exemplary tabulation or array of traffic measurement results for linkset
number 25. The counter 36 can also be configured to transmit the tabulated data to
a storage device or operator management type facility as a report on a man to
machine interface (MMI), for example, to be displayed to a user.

5 At least one embodiment of the TMD 22 of the present invention allows a network operator, for example, to use network assets to collect traffic measurements only on overdriven or overloaded communication linksets associated with one or more of the STPs 14, thus saving asset allocation expenses.

10 In at least one exemplary embodiment of the present invention (illustrated by broken line in Figure 3), the examining unit 34 is configured to enable a user to “nominate” a specific linkset for measurement collection. In this case, measurements are collected for that linkset regardless of the outgoing MSU rate. In other words, the linkset does not need to experience an overload condition in order to collect the incoming traffic measurements. This does not prevent the detection of overload on
15 other remaining linksets. The user can also enable a time period restriction means for limiting the traffic measurement collection in extended periods of overload. For example, the user can choose a limit time period of five minutes in which traffic collection is restricted to a maximum of five minutes following initiation of traffic collection.

20 The monitor/detector 32 can also be configured to compare the outbound communication linksets’ message rate with a respective predetermined underload threshold for detection of an underload threshold transition. The monitor/detector 32 can also be configured to send a signal on output 33 when an underload transition

5 occurs, instructing a termination of the of the measurement collection activity; and
issue an information and problem report when the TMD 22 begins the measurement
collection activity on a linkset and when the TMD 22 stops the measurement
collection activity.

10 One advantageous characteristic of the traffic measurement device 22 of the
present invention is memory savings and the ability to use less resources to collect
and store the measurements. Memory savings can be great, particularly in an
integrated system where the measurements are performed real-time and in-line with
traffic processing memory. In theses systems, memory is typically not plentiful and
even if it was, communication bandwidth would be sucked-up trying to get these
15 massive amounts of measurements out of the processor and onto a storage device.

Referring now to Figure 5 there is illustrated a simplified method diagram for
traffic measurement collection in a telecommunication network in accordance with
an exemplary embodiment of the present invention. To some extent these steps have
already been mentioned and the discussion of them here can be somewhat
20 abbreviated.

In act 52, the message rate is monitored for one or more communication
linksets for a network node. Subsequently, the message unit rate is compared to a

5 predetermined overload threshold and upon detecting an overload threshold
transition (i.e., the message rate exceeds the predetermined overload threshold) 54
a message examination 55 is initiated. At this point an indication can be transmitted
to indicate that an overdrive condition is detected and collection activity is to begin.
If there is no detection of an overload threshold transition, operation returns to
10 simply monitoring for the next possible overload threshold transition.

In act 55, following a detected overload threshold transition for a particular
linkset, the outbound message units are examined to determine those linksets that are
providing traffic (i.e., message units) to the particular overloaded linkset. Once the
traffic providing linksets are identified, a count is incremented at 56 for each
15 incoming message on each of the identified linksets.

In act 58, the message rate of the overloaded communication linkset is further
monitored and compared with a predetermined underload threshold and upon
detecting an underload threshold transition (i.e., the message rate falls to or below
the predetermined underload threshold) the measurement collection activity is
20 terminated at 59. The incoming message counts can be stored in a table identified
with the corresponding overloaded linkset (see also Figure 4). The table can contain
other incoming message counts identified with other overloaded linksets if more than
one outbound communication linkset is being monitored. This table can be

5 transmitted to an operator management type facility as a report on a MMI, for
example, to be displayed to a user for analysis. The report can also be stored for
future use. Further, the measurement collection activity can be aborted anytime upon
receiving a network failure condition indication. Following a measurement
collection activity termination, operation is transferred to monitoring for the next
10 possible overload threshold transition at 52.

Although a preferred embodiment of the apparatus, system and method of the
present invention has been illustrated in the accompanied drawings and described in
the foregoing detail description, it will be understood that the invention is not limited
to the embodiments disclosed, but is capable of numerous rearrangements,
15 modifications, and substitutions without departing from the spirit of the invention as
set forth and defined by the following claims.